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Managed Aquifer Recharge: A New Frontier for Addressing Emerging Contaminants

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Chemicals play a vital role in modern society, yet many, including long-standing compounds and emerging contaminants (ECs) such as PFAS, pesticides, and pharmaceuticals, remain largely unregulated or insufficiently studied. These persistent pollutants accumulate in the environment, threatening human health and ecosystems, particularly through surface and groundwater contamination. To address these challenges, a multidisciplinary approach is crucial, especially for understanding their behaviour in Managed Aquifer Recharge (MAR). At the same time, regulatory efforts must strike a balance between minimizing risks and preserving the essential use of key chemicals.

[MAR2PROTECT](#) project addresses the challenges of groundwater contamination caused by climate and global change through a holistic approach. It focuses on developing innovative technologies and tools supported by Artificial Intelligence to monitor and prevent contamination using real-time data from sensors placed at high-risk locations among others, to inform the deployment of these technologies. The NOVA FCT team is leading the development of advanced adsorption processes for the removal of PFAS and pharmaceuticals and a real-time PFAS monitoring sensor in collaboration with IT from Aveiro. These solutions aim to minimize one of the entry points for ECs by implementing quaternary effluent treatment in WWTPs and enabling its use in MAR.

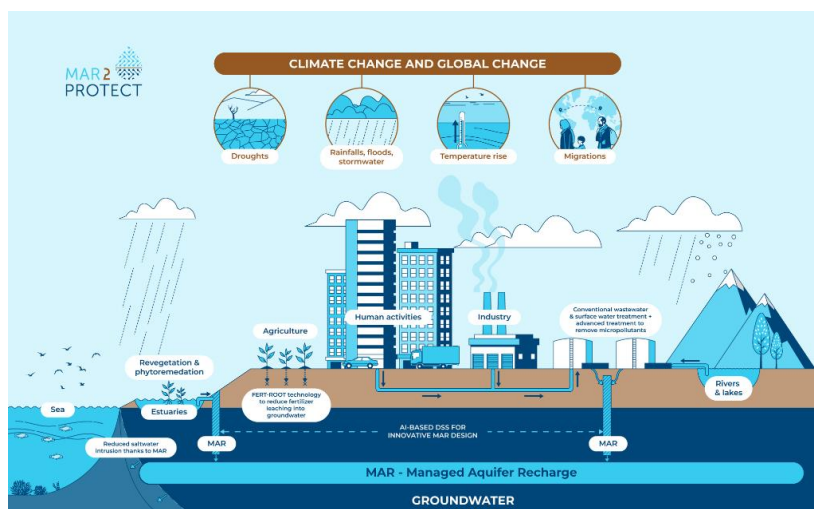


Figure 1. MAR2PROTECT approach to prevent groundwater contamination from the impacts of global and climate change (source: <https://mar2protect.eu/>)

References

[1] Mumberg, T., Ahrens, L., & Wanner, P. (2024). Managed aquifer recharge as a potential pathway of contaminants of emerging concern into groundwater systems – A systematic review. *Chemosphere*, 364. <https://doi.org/10.1016/j.chemosphere.2024.143030>